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DO IT YOURSELF REMOTE SENSING: GENERATING AN INEXPENSIVE, HIGH TECH, REAL SCIENCE LAKE MAPPING PROJECT FOR THE CLASSROOM; Stephen M. Metzger, St. Lawrence University Geography, Canton, NY, 13617.

The utilization of modest equipment and software revealed bottom contours and water column conditions of a dynamic water body. Classroom discussions of field techniques and equipment capabilities followed by exercises with the data sets in cause-and-effect analysis all contributed to participatory education in the process of science. This project is presented as a case study of the value of engaging secondary and collegiate level students in planning, executing and appraising a real world investigation which they can directly relate to.

A 1 km wide bay, experiencing marsh inflow, along an 8 km long lake situated 120 km north of Ottawa, Canada, on the glaciated Canadian Precambrian Shield was mapped in midsummer for submerged topography, bottom composition, temperature profile, turbidity, dissolved oxygen and biota distribution. Low level aerial photographs scanned into image processing software are permitting spatial classification of bottom variations in biology and geology.

Instrumentation consisted of a portable sport fishing SONAR depth finder, an electronic lead line multiprobe with photocell, thermistor and dissolved oxygen sensors, a selective depth water sampler, portable pH meter, an underwater camera mounted on a home-made platform with a bottom-contact trigger and a disposable underwater camera for shallow survey work. Sampling transects were referenced using a Brunton hand transit triangulating several shore markers. SONAR readings and bottom photographs were taken at each sampling station. Unlike most modern digital systems, the analog SONAR's spinning neon display gave different readings depending on the reflectivity characteristics of the lake bottom. Multiprobe readings were also taken throughout the water column at each sampling station, noting the level of the thermocline. The water sampler allowed independent temperature measurements in addition to acidity readings and the occasional bottom material specimen.

Kodachrome 35 mm color slides of the bay taken from a small plane at 300 m have been scanned into a satellite image processing raster GIS package (IDRISI) as a 3 band (RGB) image. This new representation is being referenced to the SONAR, lead line and underwater camera remote sensing that preceded it.

Results indicate that dissolved oxygen and turbidity levels were elevated along the wave-churned shoreline and at the marsh outlet. A distinct thermocline at 6 m depth with visible shear planes dipping lakeward separated the 2°C anoxic hypolimnion from the 18°C epilimnion. Zones of mollusks and grasses were delineated parallel to the beach by the underwater camera and snorkeling forays. Mud, sand, boulder and sunken log distributions were interpreted after correlating SONAR texture readings with snorkeling examinations of type localities.

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Students have performed all aspects of data reduction including plotting sample sites from compass readings, manually estimating topographic contours, using spread sheet software to chart temperature profiles, generating 3-D computer mesh diagram perspective views of the bottom topography (fig. 1) and more elaborate image processing procedures currently underway to derive bottom contours and the geographic distribution of bottom materials from the aerial photographs. Acetate overlays were used to link the observed conditions with their environmental settings and formative causes. They discuss all aspects of the exploration process including:

- the local environment & habitat,
- desirable research goals,
- the equipment available & its capabilities or weaknesses,
- field measuring problems and sources of error,
- plotting & computing decisions,
- whether data & analyses make sense,
- how different environmental aspects interact,
- presentation of results

and when to declare the project finished.

The very real-world flavor of this inquiry is reinforced by photographs, specimens of drift wood & mounted birds or fish, recordings of Loon calls and classroom examination of the equipment with outdoor demonstrations where possible. Every student has been responsible for reporting their results in an orderly manner. Thus the esoteric and practical aspects of science become tangible, especially when THEY propose the quest.

References:

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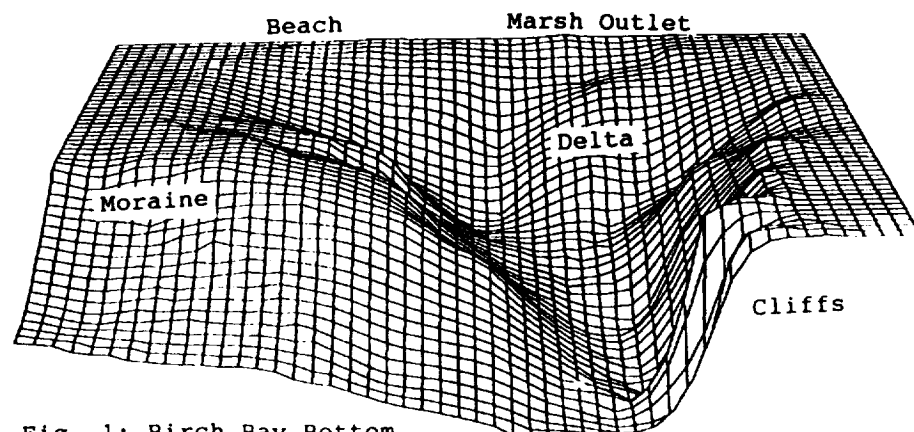


Fig. 1: Birch Bay Bottom